GEOLOGIC AND TOPOGRAPHIC MAPPING OF THE SOUTH POLAR REGION OF MARS: LOCAL STRATIGRAPHIC RELATIONS AND TROUGHS OF PLANUM AUSTRALE. E.J. Kolb and K.L. Tanaka, U.S. Geological Survey, 2255 N. Gemini Dr., Flagstaff, AZ 86001; EKolb@gecaz.com.

Introduction: Initial efforts to compile a 1:3,000,000-scale map of the South Polar Region of Mars (>70°S) have been enhanced by the use and interpretation of MOLA datasets. MOLA derived results have included determining stratigraphic relations and morphology of deposits in Promethei Rupes, general characterization of trough features within the south polar layered deposits (SPLD), and topographic analysis of the SPLD and surrounding deposits.

Deposit stratigaphy within Promethei Rupes: An extensive depositional layer within Promethei Rupes (mapped previously by [1] as part of the upper member of the Dorsa Argentea Formation (unit Hdu)) was studied to determine stratigraphic relations of features within the crater basin. Morphological features of the deposit include a lobate front along its periphery, closely spaced east-west-trending linear depressions, and many windows into underlying stratigraphy. MOLA elevation models and Viking images reveal that the deposit mantles much of the basin floor, covering approximately 80,000 km^2. Observed thicknesses range from 60 to ~150 meters, whereas the total volume of material is ~4,800 to 12,000 km^3.

Regional deposits and landforms include both intact and degraded knobby SPLD material, layered deposit mantle material, Chasma Australe, and several sinuous ridge features. The northern extent of the flow deposit embays Promethei Rupes crater rim material, and the eastern front, near 252°W, overlies Promethei Rupes crater floor material. The western and southern deposit extent appears locally overlain by the SPLD or mantled by material presumably derived from the SPLD. Part of the southern deposit front is observed at the mouth of Chasma Australe, north of the blocky, east-west trending elongated massifs (Fig. 1). The deposit is not observed south of the massifs, and elevation models identify a trough parallel to and between the massif and deposit. In Figure 1, a topographic profile of these features illustrates an abrupt unit Hdu termination followed by a smooth upward-sloping massif profile. At 253°W, 78°S where the eastern extent of the deposit is clearly visible, no observed features show the deposit originated from this area. The east-west linear features within the deposit and lack of features identifying an eastern source suggest a likely western source region.

One and possibly two ridges roughly 3 km wide and 40 km long are observed south of the area shown in Figure 1. These ridges cross half the distance of the chasma mouth, whereas another ridge is observed within the deposit directly north of the chasma mouth (Fig. 1). The spatial associations suggest that the aforementioned trough marks the extent of a pre-chasm SPLD where the adjacent unit Hdu flowed alongside, whereas the ridges represent moraines or esker features.

The esker-like ridges, including those at the western edge of Promethei Rupes, have been attributed to discharge [e.g., 2], and the stratigraphic relations between the ridges and flow deposit could represent a genetic linkage.

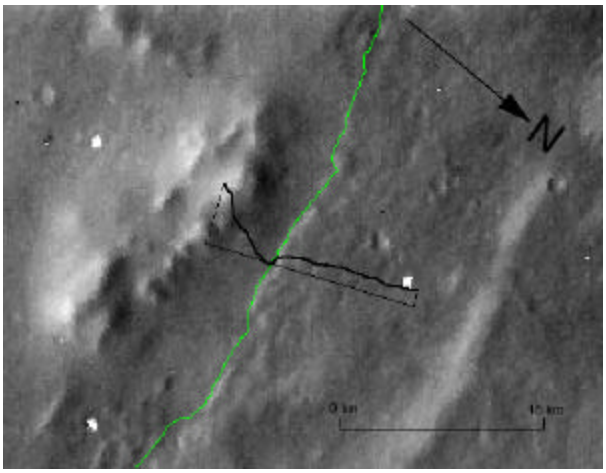

Figure 1. Section of Viking image F383b52 illustrating contact (thin line) of unit Hdu and massif at the mouth of Chasma Australe. The deposit thickness is ~60 meters. Vertical exaggeration of the topographic profile is 20X. A ridge is observed within the deposit crossing the lower right section of the figure.

SPLD trough characterizations: A profile across several troughs of the SPLD is shown in Figure 2. The profile is representative of trough topography observed within all generated profiles and can be described as a rhythmically repeating series of steps that descend from the center of the cap. Across each profile, equator-facing slopes of the trough walls are uniform, as is the thickness of the SPLD from trough floor to plateau top, or each "stair–step". Heights of the equator-facing walls range 400 to 600 m. Trough floors and plateau levels are consistently higher poleward, and trough floors are always higher than plateau levels two steps below.

Cross sections also were generated along the length of several of the largest SPLD troughs. The troughs spiral down and away from the center of the cap, and a rapid decrease in trough floor elevation is noted whenever trough direction changes. The seemingly rhythmic placement of the troughs observed in each

profile, the uniformity of step thickness from profile to profile and the inward increase in trough-floor elevation suggest that topographically controlled processes such as insolation and basal melting govern the formation and placement of the troughs seen on the present day cap.

References: [1] Tanaka K. L. and Scott D. H. (1986) *U.S. Geol. Surv. Misc. Inv. Series Map I-1802C*. [2] Head J. W. (2000) LPSC XXXI, #1121.

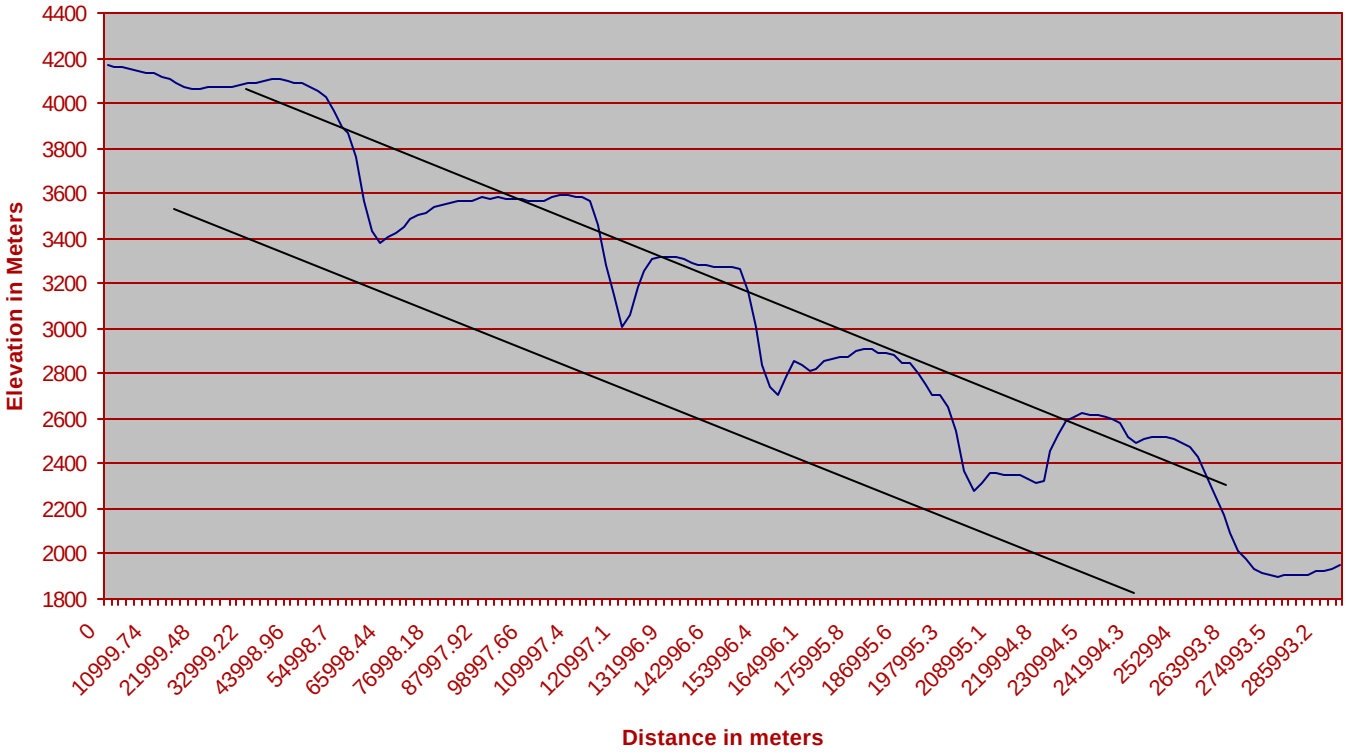

Figure 2. Topographic profile and trend lines across several major trough features of the SPLD and residual CO_2 polar cap. Symmetries observed in the profile include (1) the uniform thickness of material from plateau to trough floor, (2) the horizontal spacing of the trough "steps", (3) uniform slopes of the equator-facing trough walls, and (4) as compared to the graph trend lines, parallel slopes between the trough floors and plateaus. The symmetries suggest that topographically controlled processes govern the formation and placement of the troughs seen on the present-day cap.